

EMERGING TECHNOLOGIES



ENERGY↔WATER
CONNECTION



Flap Gate

In 1992, the Irrigation Training and Research Center (ITRC) at California Polytechnic State University began to investigate early designs of Flap Gates. Originating in Holland in the 1940's, the Flap Gate is a simple, inexpensive hydraulic gate for automatic upstream water level control. After modifications to the design were made, ITRC and Chowchilla Water District constructed and tested Flap Gate prototypes. Currently, there are over 60 ITRC Flap Gates in use within four districts. An Alta ID example is shown below.



Flap Gate at Alta ID (7/24/00)

Benefits

The ITRC Flap Gate:

- Operates steadily at varying flow conditions
- Maintains water level elevation typically within ± 0.5 inches of design, allowing maximum flow through the canal with little deviation
- Maintains consistency in water travel times
- Contains fewer mechanical parts than most other gates
- Can be completed in one week from design to installation with experience
- Is often installed in less than two hours and while water is flowing
- Water delivery flexibility is enhanced because canals become easier to operate

Design

A Microsoft Excel[®] spreadsheet at www.itrc.org/reports/reportsindex.html allows a user to customize a design of the Flap Gate for a given set of dimensions of the location where the gate is to be in service. Practical hints for successful application as well as the theory behind the Flap Gate are described in an accompanying web site report, "Flap Gate for Automatic Upstream Canal

Control.” The gate is easily constructed and basically consists of steel, two bearings, two struts, and few bolts and nuts, as well as material for the counterweight.

Installation

The ITRC Flap Gate is typically constructed in the irrigation district shop. It is then installed using a crane, which hoists the gate into place (depending on size) where it is secured with large bolts into a concrete structure. In most cases, the gate may be placed where flashboards were once located. Flap Gates are often installed in less than two hours and while water is flowing.

After securing the gate, the counterweight is partially filled with concrete. For smaller Flap Gates, it may be possible to install the gate with some of the counterweight material already in place. In order to achieve the desired upstream water elevation, the Flap Gate is calibrated by adding lead buckshot or additional concrete to the counterweight, which is located on the top of the Flap Gate as shown in the Turlock Irrigation District Flap Gate photo.



Flap Gate at Turlock ID (6/21/00)

Maintenance

The Flap Gate is designed for automatic function and requires virtually no maintenance, making the Flap Gate a very desirable choice for upstream control. It may be necessary to flush debris such as twigs or other material from the Flap Gate every one or two days, but the Flap Gate results in lower labor costs compared to flashboards because there are no boards to be

changed. The bearings, which allow the Flap Gate to rotate, should be greased every year and re-painting should be done when required depending upon use and climate conditions.

Water Conservation and Efficiency

- Improved control of farm deliveries enables growers to effectively use their water
- Advanced control of water levels and ease of operation reduces spills – which reduces pumping at the supply points of canals

Cost

Costs vary widely between districts. The Turlock ID gates are generally the largest and have been put into new structures – costing up to \$7000 for gates of about 120 CFS. Chowchilla Water District installs gates at about 50 cfs for close to \$1,600, including fabrication and labor. Broadview Water District put in a 30 cfs Flap Gate for approximately \$700. Alta Irrigation District’s gates cost about \$1,100 to build and install.

Use

Districts where the ITRC Flap Gate has been installed (1/2001) include:

- Chowchilla Water District
 - Currently 45 gates have been installed with many more planned for the future.
- Turlock Irrigation District
 - Currently four gates exist in the district. More are being planned to operate in the 2001 irrigation season.
- Alta Irrigation District
 - Ten gates are in use, and 50 more are in the planning process.
- Broadview Water District
 - One gate is in use and district personnel are reviewing potential locations.

Benefits

Every district surveyed reported that the growers who were affected by the installation of the gates were extremely pleased since the

gate not only provided higher water levels, but also allowed greater flexibility in the ordering of water.

By installing the ITRC Flap Gate, a district will be able to better serve its customers. Growers and district staff in various areas have frequently commented on the consistent water levels provided by the Flap Gate and encourage its use wherever possible.



Doug Welch, manager of Chowchilla Water District, has been instrumental in assisting with the design and adoption of the Flap Gate technology.

The Flap Gate generally saves labor cost and mileage; ditchtenders do not have to go back and forth along the canals as frequently as with flashboards. Weed and pest control expenses are reduced due to higher water levels. Plus, there may be an opportunity to have less spillage at the end of the system. Chowchilla Water District saves on general maintenance, and has eliminated canal breaks where the gates are installed. The following breakdown illustrates which areas of operation have reduced in cost in Chowchilla Water District.

Chowchilla Water District Savings

Labor	8-10%
Mileage	15%
Weed Control	2-3%

For Further Information

- **Chowchilla Water District**
P.O. Box 905
Chowchilla, CA. 93601
Doug Welch, Manager
(559) 665-3747
- **Alta Irrigation District**
P.O. Box 715
Dinuba, CA. 93618-0001
Chris Kapheim, Manager
(559) 591-0800
- **California Energy Commission**
Ricardo Amon
(916) 654-4019
Ramon@energy.state.ca.us
- **Irrigation Training and Research Center**
California Polytechnic State University
San Luis Obispo, CA. 93407
Dr. Charles Burt
(805) 756-2379
cburt@calpoly.edu



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